# JAWS S³ — Making Information Work for the Warfighter

## Annual Symposium Gaining Momentum, Promoting Joint Operations Cooperation, Communication, Decision Making

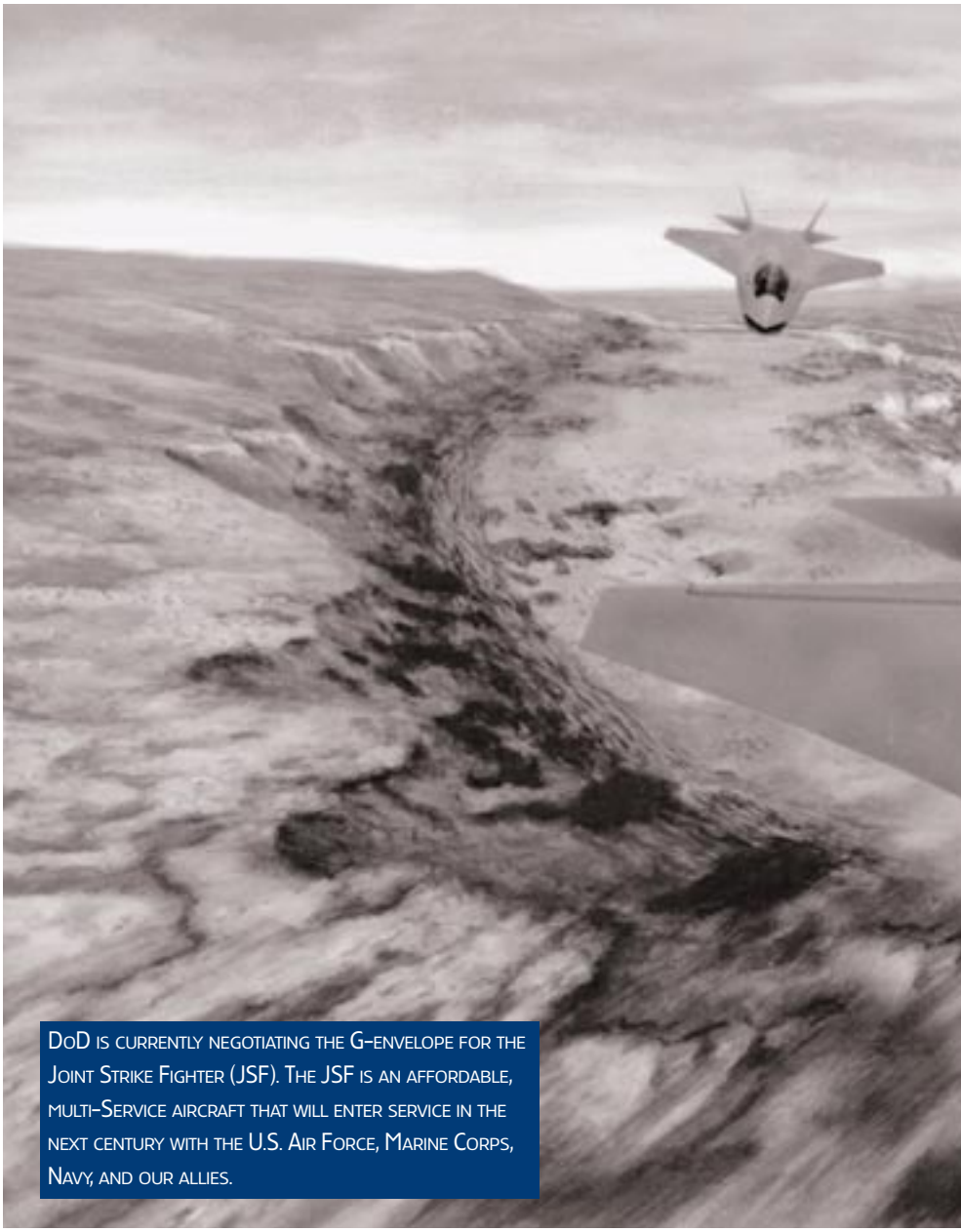
COLLIE J. JOHNSON

From technology development to Advanced Concept Technology Demonstrations; from systems acquisition to Modeling and Simulation (M&S) for training and exercises — government and industry are preaching and practicing acquisition reform, and promoting best practices and processes to field affordable, reliable, maintainable, technologically superior weapon and support systems.

Truly achieving DoD's *Joint Vision 2010's* objectives of information superiority and full-spectrum dominance are dependent on one common element: *Information.* Information technology is increasingly critical in maximizing warfighter effectiveness. In fact, *Joint Vision 2010* is built on the premise that modern and emerging technologies, particularly information-specific advances, should make possible a new level of joint operations capability.

### Easy to Say, But Will They Buy It?

Probably the hardest part of achieving *Joint Vision 2010's* objectives of information superiority and full-spectrum dominance, however, will be attaining the buy-in, interaction, synergy, and partnership of all the DoD acquisition workforce and defense industry communi-



DoD is currently negotiating the G-envelope for the Joint Strike Fighter (JSF). The JSF is an affordable, multi-Service aircraft that will enter service in the next century with the U.S. Air Force, Marine Corps, Navy, and our allies.

Image courtesy Boeing

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ties of practice, such as test and evaluation, operations, aerospace systems, acquisition development, obscurants/sensors, and many more.

The Joint Aerospace Weapon Systems Support Sensors and Simulation Symposium (JAWS $S^3$), a forum conceived 10 years ago for just that purpose, is making inroads and gaining momentum each year as it brings DoD's diverse communities of practice together to talk, listen, think about things in different ways, share solutions, present lessons learned, network with other professionals, and explore new technologies.

"Making Information Work for the Warfighter," was the timely and relevant theme selected for the 1999 JAWS $S^3$, held in San Diego, Calif., June 13-18. A diverse sponsorship included all the military services as well as the following DoD Components/Agencies:

- Deputy Director, Operational Test & Evaluation/Live Fire Testing, Office of the Secretary of Defense (OSD)
- Director, Sensors and Electronics, Office of the Director, Defense Research and Engineering, OSD
- Technical Director, Office of Naval Research

"People come together here [JAWS $S^3$], with different facilities of engagement, exploration, and alignment. This conference/symposium is really designed to directly serve the multidiscipline needs of our Joint Services. And one of the reasons why it's been very effective for us is because it's helped us focus on satisfying the needs of our operational decision makers."

—Air Force Lt. Col. Stanley J. Jarzombek Jr.

- Director, Embedded Computer Resources Support Improvement Program (ESIP) Program Office, Ogden Air Logistics Center, Hill AFB, Utah.

## JAWS is About Communication

Air Force Lt. Col. Stanley J. Jarzombek Jr., program director for the Embedded Computer Resources Support Improvement Program (ESIP), who has been actively involved in JAWS for over five years, explains that JAWS is facilitating communication among different communities of practice.

"People come together here, with different facilities of engagement, exploration, and alignment. This conference-symposium is really designed to directly serve the multidiscipline needs of our Joint Services. And one of the reasons why it's been very effective for us is because it's helped us focus on satisfying the needs of our operational decision makers. We've brought operations between the acquisition R&D [Research and Development] community and the test and evaluation community closer together. And it's really caused an interaction and synergy among those communities of practice."

Jarzombek explained that in the early years, JAWS was focused on the test and evaluation and support community of practice; it then evolved with the changing mission environment to include those involved with obscurants, sensors, aerospace systems, and acquisition development, and how all of these different communities of practice, together with the M&S community, interact.

A 1999 JAWS organizer and avid supporter, Jarzombek finds great value in that coming together, and encourages participants to "... make sure that other people within your organizations understand what JAWS has to offer in the way of technical and professional development."

## Scratching the Warfighters Where They Really Itch

James F. O'Bryon, Deputy Director of Operational Test and Evaluation/Live Fire Testing, Office of the Secretary of Defense, and co-sponsor of the 1999 JAWS $S^3$ forum, opened the conference with a brief welcome to the participants, followed by a question directed at the very reason for their participation in JAWS.

"What is *information*?" he asked them. A lot of people, he noted, would answer that question in a lot of different ways. O'Bryon, however, defined information as, "inputs that provide a logical and useful basis to draw meaningful and timely conclusions on a given topic." And information, he told them, needs four things: a sender, a receiver, meaningful content, and a way to get it to the receiver. "All of them are necessary," he said, "to get what we call ' information' to the warfighter, from the warfighter to the command post or to others who might be supporting the mission."

O'Bryon said that during the symposium, the participants would be hearing about information in two contexts. "First of all, we're going to be talking about information necessary for the warfighter to support real-time combat decisions and operations. The other context in which they would be hearing about information, he said, was equally important.

"Not only does the combat operator out there need real-time information, there is also the need to have a method of transferring his or her needs from the battlefield, back through the acquisition system, to *make sure that we're scratching the warfighters where they really itch."*

## Give Them What *They* Need, Not What *You* Think They Need

O'Bryon emphasized the importance of really understanding the warfighter's requirements. "Be careful," he said, "to answer the question that's being asked, not some other question." Also understand the environment in which folks are going to be functioning. "We've got to realize that the combat situation is much more dirty, much more involved, and much more complicated." Get in early, he advised. "We need to affect design as early as possible and not come back and try to redesign [a system] over and over again. Why? Because it's *very, very, very* expensive."

Modeling and Simulation [M&S] alone, he added, is not the answer. "That doesn't mean M&S is useless, but that we've got a long way to go." He quoted Dr. Jacques S. Gansler, Under Secretary of Defense (Acquisition and Technology), who said, "Weapons systems conceived and formed in computers are already a reality, but the idea of extending modeling and simulations under weapons systems testing and life cycle operations and support for feedback [in the] design stage is a much more audacious step."

"At this symposium, we're going to get down to business and address those things," O'Bryon said. "It's our duty as designers and engineers, or whatever our function may be, to communicate for the people who are asking for the system, to the people that are designing it, what that warfighter's requirements really are."

Citing the case of the Joint Strike Fighter as an example, he said that right now, DoD is negotiating what the G-envelope needs to be for the Joint Strike Fighter. "Just asking for one more G could be very costly," he told the conferees. "What do you get back for it? We've got to make sure that those who are asking for changes or modifications understand the implications." Perhaps it might mean one less plane, or half as many planes, he said. "The total impact of these trades is not very obvious, and we need to make sure we communicate the implications quite clearly — not arrogantly, but in a manner that ensures they're known and understood."

## Two Critical Customers

O'Bryon told the conferees that there are only two customers the DoD T&E community really must satisfy. One is the Secretary of Defense and the other is the warfighter, "... the person out there who is risking his or her life to meet the challenges and fulfill the mission that they've been sent to do. Everyone in between," he emphasized, "including me and all of us here, are part of the solution. We don't have to be happy, but we need to make sure that we are contributing to making those two people happy — the Secretary of Defense and the warfighter."


"DoD needs to aim where we think the threat is going to be … Wayne Gretsky was often asked why he was so successful in his hockey playing. Gretsky's answer: 'I don't aim where the goal is and I don't aim where the player is to whom I'm passing the puck. I shoot the puck where the skater is going to be when the puck gets there.'"

—James F. O'Bryon

In other words, O'Bryon said, "*We need to pool our resources and not lose energy to unnecessary heat*."

## Aim for the Threat

DoD needs to aim where we think the threat is going to be, according to O'Bryon. To illustrate, he referred to famed hockey player Wayne Gretsky, who was often asked why he was so successful in his hockey playing. Gretsky's answer, O'Bryon said, was simple but profound. "I don't aim where the goal is and I don't aim where the player is to whom I'm passing the puck. I shoot the puck where the skater is going to be when the puck gets there."

He noted that the legislation that governs his office [Live Fire Testing], directs that his office test against *expected* threats – not just current threats, but the *expected threat in the outyears*. "Very, very difficult," he observed.

## Change is Constant

It was Heraclitus who said about 2,300 or 2,400 years ago, "The only constant in the universe is change." Former Marine Corps Commandant Gen. Charles C. Krulak also alluded to change when he said, "We have a whole New World coming. If we go to war, it's not going to be linear or symmetric. It's going to be chaos." Strom Thurmond, the oldest member of the Congress, recently said, "There is no question that we have a sacred obligation to do everything possible before our people and weapons are committed to the harsh reality of the battlefield."

Yes, there's resistance to change, O'Bryon acknowledged. "But while you're at this symposium and when you leave, can I challenge you to 'think outside the box'? Let's not make our solutions more complicated than they really need to be," he added. "Do we really need to develop a ballpoint pen that writes in zero gravity, or can we simply use a pencil?" In other words, "There are lots of ways to answer a question, some of them deceptively simple," he concluded.

## Making Information Work For the Warfighter

Retired Air Force Gen. Larry D. Welch, President, Institute for Defense Analyses and former Air Force Chief of Staff, served as the 1999 JAWS $S^3$ keynote speaker. Referring to the symposium theme, he said that he could think of few subjects or challenges more important than, "Making Information Work for the Warfighter." To put the subject into context, Welch talked about three issues:

### Focus on What the Warfighter Cares About

The first issue was simply the need to focus very clearly on what the warfighter cares about. And what the *warfighter* cares about, he noted, may be quite different from what the *information systems community* cares about.

### Complexity of Battlespace Situation/Operations

Welch said "complexity" is the word that best describes today's warfighting environment. DoD expects the warfighter to deliver capabilities quickly and effectively that will allow our nation to dominate any adversary across the spectrum of conflict at every level of conflict.

"That means," said Welch, "that battlespace decision makers at all levels are directing multifunctional forces; that is, forces who do several things simultaneously, forces that have to be quickly tailorable, quickly deployable, rapidly adaptable, and operating in situations for which there is no rehearsal and in many cases for which there is very little specific preparation." DoD's task then, according to Welch, is to determine how to provide information to that range of situations that allow decision makers to make battlespace decisions.

### Information Overload

The third issue was information overload. Welch challenged the audience to consider two questions. "When was the last time that you were asked to make a decision where you had too much information? When was the last time you were asked to make a decision when you had too little information?" The ratio, he said, is at least "a hundred to one in favor of the latter. DoD needs to limit the information pushed directly at the warfighter and make a very rich set of rele-

Photos by Dr. Jay Gould

vant information available for the warfighter to pull, when needed, that allows those warfighters at all levels across the spectrum to make decisions that are always better and faster than the adversary can make."

Welch has a simple solution to overload. "Don't do it. Simply, don't do it." He added that he understands the necessity to package information so that it's more useful, and to screen out as much irrelevant and extraneous information as possible. "That doesn't mean I want to simplify the information available to that decision maker," he explained, "I want to enrich it. I want to give warfighters more relevant information."

## High-Level Architecture

Welch also talked about the importance of a high-level architecture for battlespace decisions and four elements that have to be in an architecture:

### Enablers

First are the enablers—communications, storage, extraction, accessing, labeling, perception aids, protection, and collaboration. Those are all important, said Welch. "Some of them are hard ... They're not the real drivers ... We know how to do most of those."

### System Control

Second is system control, performance, access control, bandwidth allocation, and network management. These are also important, said Welch. "We have to be able to do that. We know how to do that. But they're not the drivers."

### Collection and Input

The third is a matter of collecting information from all those sources and pushing that information into accessible networks. This area is complex, Welch said, but noted that packaging and screening out extraneous information are good. All these things are important, he said, but they're not the driver.

### Leveraging Information to Make Informed Decisions

The fourth is the purview of the battlespace leader and the battlespace decision maker. Welch described this as the ability to pull out of that system the information that a battlespace decision maker finds to be useful for their situation, for their management style, for their combat leadership style, and for that moment in time. "I suggest to you," said Welch, "that it is the fourth element that has to drive all the rest."

"We can all agree that the outcome of most conflicts is decided by human performance, not machine performance, that the most compelling contribution to the art of war has little to do with the so-called rules of war or principles of war. The outcome of combat is decided by the courage of the soldiers, the quality of their leadership ... and their ability to make combat decisions that are relevant. And the ability to make relevant battlespace decisions is based on our ability to provide the right kind of information."

—Retired Air Force Gen. Larry D. Welch

## Asymmetrical Advantages

Welch talked about two asymmetrical advantages this nation now has over its adversaries—one *enduring*, the other *non-enduring*.

### Non-enduring—Information Superiority

The one that will not endure, he said, is information superiority. We enjoyed almost absolute information superiority during the Gulf War, he noted. The information revolution is spreading at such a pace, however, that he believes within a decade wide bandwidth and high-resolution centers will be available to anyone who has the money to buy the services. To counter that, Welch said that those who use commercial services will probably be better off than those who don't. The pace of change is so fast that he believes there's almost no possibility that the defense acquisition system will keep up with the commercial development pace. "Information superiority is transitory," he said, "and will not last."

### Enduring—Decision Superiority

Decision superiority can be enduring, according to Welch. We have a cultural advantage in decision superiority that will be very difficult for anybody else to manage simply because we're, according to Welch, "a nation of information junkies." He noted that the average American child absorbs more information in a day than the adult in almost any other society on the face of the earth. "That's simply a cultural advantage that we have. It's no accident that the Internet was invented and prospered here. It's no accident in history that virtually every fundamental communications advance has been invented here. It's no accident that computer development pioneers saw the modern computer as an enormously important

computational machine ... as an information provider, a communications device, and decision enabling device. That all happens," Welch concluded, "because of the culture in which we live. So that's an asymmetric advantage that we can exploit."

But to exploit that advantage, Welch believes we still need to change the *information culture* from a push system (I will decide what you need, I will work with you closely, figure out what you need, and provide it), to what he calls the *Internet culture* (I have to make available to the battlespace decision maker [at all levels] a rich set of information from which they build their own information ensemble, from which they structure their own flow that comes to them and fits their style and their situation, that's infinitely tailorable and infinitely modified). "That," he concluded, "we *do* know how to do."

## A Tricky Transformation

Getting through the transformation to these revolutionary advantages can be tricky, Welch acknowledged. It means lots of questions, lots of risks, and lots of experimentation. "It means we simply have to have a series of experiments until we find out what works and what does not work and what we have to change to make the important stuff work."

Welch concluded his remarks with a challenge. "We can all agree that the outcome of most conflicts are decided by human performance, not machine performance, that the most compelling contribution to the art of war has nothing to do with the so-called rules of war or principles of war. The outcome of combat is decided by the courage of the soldiers, the quality of their leadership, and their ability to deal with chance, that is, their ability to take advantage of favorable chance or good luck and their ability to minimize the adverse effects of unfavorable chance or bad luck. All of that is based on their ability to make combat decisions that are relevant. And the ability to make relevant battlespace decisions is based on our ability to provide the *right* kind of information."

Herein lies the challenge, according to Welch: to figure out how to move to that kind of capability, how to do it with acceptable risk, and how to know what pace of change that the force can stand. "It's a very big set of challenges," he observed, "with very big payoffs." He stated that we have no choice but to meet that challenge. "Because if we don't, then we will give up the most important asymmetric advantages that we have — an information culture and the quality of people that we have using this information — those are the two reinforcing asymmetric advantages that we simply have to leverage into the 21st century."

## Consensus Building

Throughout the one-week conference, seven areas of concern to all the acquisition and technology communities of practice emerged as recurrent issues:

### Defense Budget

The nation and DoD can ill afford to ignore the realities of what this country needs. When we do, as one panelist commented, "Historically, we wind up fighting a war without the right tools, and we pay for it in the precious blood of our youngest generation." If we don't change this trend in the next few years, we are going to be right back in that same awful mess of having ignored our security.

### Retaining the Technical Workforce

The military has "kept the schoolhouse open" so to speak, but in the civilian community, the story is quite different. Looking at DoD's civilian ranks, the Department has virtually not hired for the last 10 years, to the point that there is now an almost missing generation. If this trend continues, 15 years from now when people who are seasoned and experienced should be in positions of running DoD's weapons programs and systems, the generation that should have been there to occupy those positions will essentially be missing. Industry too has a serious problem retaining people on government work. Typically, government work is regarded as a hassle, too much paperwork, with too little profit. Unless industry and DoD want to see themselves bereft of good workers, they must remedy this situation.

### Industry Involvement (Partnering)

Because the previous relationship of customer-supplier is rapidly evolving toward partnering, that requires industry to become an active participant in engineering trade-off decision processes throughout the research and development contracts and downselect phases. Industry must be heavily involved up-front, not just in the delivery.

### Return on Investment

If the nation expects industry to put its very best brain power on problem-solving processes so that the national security establishment is well served, DoD must figure out a way in which the purchasing reform process can give industry an adequate return on its investment. Otherwise, industry has no incentive to put its best talent on the problem. Government, in turn, will wind up with more and more Commercial Off-the-Shelf (COTS) technology and products designed for other users being adapted to government's purposes.

### Embracing Rapid Change

When the nation is standing still technologically, everybody else is catching up. And a nation standing still makes a tempting target for those who might want to co-opt or penetrate the country's critical defense systems and infrastructure. Adversaries can and will use the nation's dependence on critical systems as a vulnerability or a type of asymmetrical response to our systems and weapons superiority.

We need to embed in government and industry the idea that the nation is consciously turning over its critical weapons systems at a very high rate. The answer to rapid change, as one panelist commented, is "Don't fight it. Join it. It's your friend, not your enemy. Make change your asset. Embrace change."

It's much more difficult to attack a moving target than a stationary one. If adversaries see our systems — our infor-

mation systems and communications systems — as a moving target, one that we are consciously moving, it then becomes significantly more difficult for an adversary to attack or use our vulnerabilities against us.

### Maintaining the Technological Edge

Technology cannot be kept in a box. Nuclear threats or other unconventional threats, such as chemical or biological warfare, are the kinds of threats that the nation is going to have to respond to in the next 15 years. Unless we wake up to that, we're going to, as one of the conference sponsors commented, "*... still be chasing the problem instead of leading it. We still have the technological edge, but we don't have our eye on the ball.*"

### Exploiting Test and Evaluation, Modeling and Simulation

The state of DoD's Test and Evaluation and Modeling and Simulation should continue to be considered from every aspect. But the United States must never believe that success in these two areas equals the real test.

The most difficult thing to simulate is the cleverness of an adversary. To outguess an adversary who's well informed and willing to take risks — that's the most difficult thing of all. That's a performance responsibility that, ultimately, is solely in the hands of the government.

## What's Going On In the Battlespace?

General Larry Welch summarized what it will take, he believes, for DoD to truly make information work for the warfighter: "We want every commander and operational leader to know what their commander wants and expects them to do; we want them to have an accurate up-to-date picture of their commander's intent.

"... The business of everyone understanding the commander's intent ... such that the commander's intent is based on a valid understanding of what's going on in the battlespace, and of having every commander at every level knowing what's going on around them — what's in front of them and what's behind them — that's the kind of *information superiority,* that's the kind of *decision superiority* that we're talking about to enable and take advantage of what should be an inherent advantage."

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# Architecting for Information Superiority

RON TURNER

In the past 24 months, the Department of the Navy Chief Information Office (DON CIO) sponsored two integrated product teams that have produced Information Technology (IT) architecture and standards guidance products that are fundamental building blocks for building an enterprise information infrastructure. These two products are for use by all DoN organizations and will enable the DoN to leverage information technology to better perform its missions.

In the mid-1990s, the General Accounting Office (GAO) published a widely acclaimed study, known as the "11 Best Practices for Information Technology." An alarming percentage of organizations implementing IT were failing, particularly in government. GAO found that in industry and government organizations that had successfully implemented IT programs, there were 11 best practices consistently and commonly employed. One of the most important of these was a defined and accepted set of IT architecture and standards. The tenets of the "Best Practices" were a foundation for the Clinger-Cohen Act of 1996, which in turn, was the genesis of the Office of Management and Budget Memorandum 97-16, Information Technology Architectures (ITA). The ITA requires the DON CIO to develop, maintain, and facilitate the implementation of the DoN's information technology architecture.

Responding to this, the DON CIO sponsored two separate, highly successful Integrated Product Teams (IPT). In the past 24 months, these IPTs have collaboratively developed two acknowledged outstanding ITA-related products. Both IPTs had representatives from each of the major Navy and Marine Corps organizations, their drafts reviewed by all Department organizations, and the final products unanimously approved by the DON CIO Board of Representatives.

The first product is the architecture document, known as the "DoN Information Technology Infrastructure Architecture (ITIA), Volume I." It was written by a 40-member Navy and Marine Corps team, led by Don Endicott of SPAWAR [Space and Naval Warfare Systems Command] and Ron Broersma, of SPAWAR [Systems} Center, San Diego. The ITIA describes the manner in which information will be exchanged over networks at the wide area, the metropolitan area, and the campus area. The complex document defines the ITI components, identifies demarcations, selects protocols, describes network services, suggests best practices, establishes performance metrics, and states how security mechanisms will be employed.

The second product is a standards document, known as the "DoN Information Technology Standards Guidance (ITSG)." It was written by an IPT led by Randy Cieslak, of SPAWAR and CINCPACFLT [Commander-In-Chief, U.S. Pacific Fleet]. The ITSG identifies and describes IT specification standards, products, and best practices for the DoN based on established criteria of security, functionality, interoperability, performance, and cost. A feature throughout the ITSG is the depiction of the recommended, emerging, and not recommended standards or technologies, to be used in conjunction with the ITIA by all Navy and Marine Corps IT managers for consistent IT planning, development, and implementation.

The ITIA successfully developed a solution path by acknowledging the multitude of legacy physical networks in the DoN that must be accommodated, and the diversity of the customer communications requirements—operational, organizational, and functional—which must be supported. The resulting solution is a network of networks, that must be melded to attain the required functionality, interoperability, and security across the DoN in the near term, and a